SYLLABUS

Course Code	*Course Num.*	*Course Name*	*Credit Hours*	*Lec.*	*Lab.*	*Tut.*	*Private study*	*Pre-requisites*	*Course Level*	*Teaching Language*
MAT	**642**	**Numerical Methods for ODEs**	**4**	**3**	**0**	**1**	**9**	**MAT641**	2^1-2^2	**English**

A. Course Description

This course is the follow up of MAT641 course taught in Master 1. It is the second part of numerical methods devoted to ODEs. In this course, all fundamentals methods will be exhibited and detailed, for ODEs and for systems of ODEs. Boundary value problems, finite difference will also be considered in this course. Error & convergence analysis will be analyzed. Moreover, Matlab software will be used as support for implementation of numerical methods.

B. Course Outcomes

At the end of this course the student will be able to*:*

1. Give an overview of different numerical methods for solving Ordinary differential equations.
2. Compare the various methods by studying their convergence, consistency and stability
3. Deal numerically with different type of Differential equations (IVPs, BVPs, systems of ODEs)

C. References:

1. **J.D. Lambert,** *Numerical Methods For Ordinary Differential Systems, The Initial Value Problem, John Wiley and Sons, 1997.* ***(Main Reference)***

Required Textbook

2. **J.C. Butcher,** *Numerical Methods for Ordinary Differential Equations, , John Wiley and Sons, 2008.*
3. **A. Stanoyevitch,** *Introduction to Numerical Ordinary and Partial Differential Equations Using MATLAB, Wiley 2005.*
4. **L.F. Shampine, I. Gladwell, and S. Thompson**, *Solving ODEs with Matlab;* Cambridge University Press , 2003.

Course Website: Google Classroom Webpage:http://www.imamm.org/

D. Topics Outline

1. **Introduction:** Preliminaries. Existence, Uniqueness, and wellposedness; Stability and Asymptotic Stability.

2. **Ordinary Differential Equations (single step method):** Implicit and Explicit Euler schemes, Local and global error, Taylor and Runge-Kutta methods, Error and convergence analysis, Stability.

3. **Ordinary Differential Equations (multistep method):** Predictor corrector methods; Implicit Methods and Stiff Equations; Convergence, Stability and Consistency of these methods.

4. **Boundary-Value Problems:** The shooting method, Finite difference method, Error and stability, nonlinear BVPs.

5. **Systems of Differential Equations and high order ODEs:** Numerical methods for solving system of first order differential equations, Direct Methods for Higher Order Equations.

E. Office Hours

Office hours give students the opportunity to ask in-depth questions and to explore points of confusion or interest that cannot be fully addressed in class.

F. Exams & Grading System

The semi-official dates of the exams for this course are:

- **Midterm :** 8^{th} or 9^{th} week.
- **Quizzes & Homeworks:** During the semester.
- **Final Exam:** 16^{th} week.

Your course grade will be based on your semester work as follows:

Midterm : 30 %	**Final Exam:** 40 %
Quizzes, Homework, Attendance & Participation: 30 %	

The grading distribution:

A^+	A	B^+	B	C^+	C	F
[95, 100]	[90, 95)	[85, 90)	[80, 85)	[75, 80)	[70, 75)	[0, 70)

G. Student Attendance/Absence

Only three situations will be considered as possible excused absences:

- Occurrence of a birth or death in the immediate family will be excused. ("Immediate family" is defined by the University as spouse, grandparents, parents, brother, or sister).
- Severe illness in which a student is under the care of a doctor and physically unable to attend class will be excused. Students are not excused for a doctor's appointment. Do not make appointments that conflict with rehearsals. Notes from the University Health Center will be accepted.

Executive Rules for Study Regulations and Examsgoo.gl/ykm7t3

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